

A NEW GENUS OF ABROGRAPTID GRAPTOLITE FROM THE ORDOVICIAN OF SOUTHERN SCOTLAND

by ISLES STRACHAN

ABSTRACT. The new genus and species, *Metabrograptus scoticus*, of the family Abrograptidae is described from the Upper Ordovician (Glenkiln Shales) of southern Scotland. The new genus bears the same relationship to *Abrograptus* as *Dicranograptus* bears to *Dicellograptus*. The recognition of this further type in the family perhaps adds some weight to Finney's (1980) reference of *Reteograptus* to the Abrograptidae. Although there are problems of homologizing stipe structure, it is clear that the biserial retiolitoid condition in Ordovician forms can be derived in more than one way.

THE Family Abrograptidae was erected in 1958 by Mu to accommodate his new genus *Abrograptus* and *Dinemagraptus* Kozłowski, 1951. The family was characterized by the extreme reduction of periderm in forms with a modified dichograptid type of development and, in conformity with his views on trends in the evolution of graptolites, the family was seen as a different line from the Retiolitidae, although similarities with *Reteograptus* were noted. In particular, Mu (1958, p. 265) mentioned that the 'split specimen referred to *Retiograptus geinitzianus* Hall by Elles and Wood (1908, p. 316, fig. 209c) resembles closely *Abrograptus* in general aspect'.

This specimen (BU1336b) is on a card from the Lapworth Collection with two other specimens. One of these (BU1336a) was figured by Elles and Wood (1908, pl. 34, fig. 7d) as 'part of ventral lattice' of *R. geinitzianus*, and the third specimen (BU1336c) I presumed was the counterpart of the first. When I had them photographed recently, however, it was clear that this was a second specimen with the stipes united proximally. The card is labelled in Lapworth's writing as *Clathrograptus cuneiformis*.

In his detailed description and revision of Hall's *Reteograptus geinitzianus*, Finney (1980) pointed out the differences between *Reteograptus* and the other members of the subfamily Archiretiolitinae, in particular the simple clathrial framework and sicular details in *Reteograptus* which are very similar to those of *Abrograptus*. He therefore transferred the genus to the Abrograptidae which he emended to include biserial forms.

The genera *Parabrograptus* Mu and Qiao, 1962 (with a pair of threads from the sicular apex forming a third 'branch') and *Protabrograptus* Ni, 1981 (with the sicular lying along one stipe) have been added to the family, the former genus being also recorded from Canada (Jackson 1966). Mu and Qiao (1962) also described another new genus, *Jianshanites*, which has single filaments like *Dinamagraptus* but which shows branching. Its sicular is much stouter than in other genera of Abrograptidae.

In the absence of fusellar details of the proximal end, it is difficult to decide on the developmental type present. Kozłowski (1951) regarded *Dinemagraptus* as having dichograptid development in keeping with its simple structure and Arenig age. Mu and Qiao (1962) have added a second species, *D. sinicus*, which is of Caradocian age (*N. gracilis* zone), associated with *Abrograptus*. In their description of *Parabrograptus*, from the same horizon, they mention the occurrence of 'an additional oblique filament in the crossing canal region' which possibly indicates the presence of a second crossing canal as in isograptid or leptograptid development. The third 'branch' could then be interpreted as similar to that seen in a number of specimens of *Leptograptus* (centribrachiate

forms of Elles and Wood 1903, pls 14 and 15). *Protabrograptus* could similarly be interpreted as showing the position of the sicula seen in *Dicellograptus exilis* Elles and Wood (Strachan 1986). Finney regards *Reteograptus* as having isograptid development since he recognizes two crossing canals but notes that 'it is peculiar because all proximal thecae grow upward' (Finney 1980). In the absence of fusellar structure, it would, I think, be difficult to prove that $th2_2$ was derived from $th1_2$ rather than $th2_1$, i.e. that the development was isograptid rather than diplograptid or dicellograptid. Unfortunately, not enough is known about the development in various *Dicellograptus* and *Dicranograptus* to know how they relate to the diplograptid story.

There is a further problem with Finney's (1980) placing of *Reteograptus* in the Abrograptidae. This relates to the nature of the lists of the stipes. Finney calls them ventral lists in *Abrograptus* but Bulman (1970) regarded them as dorsal, although lateral might be the best term since they are paired on each theca. At any rate, they are simple straight or slightly curved structures with the apertural loops separating off each section of the stipe. In *R. geinitzianus*, the ventral lists of Finney are curved or angular structures which are clearly not strictly ventral since the apertural loops occur in the middle of each curved list. The upper part of the curve, above the aperture, is a cross structure between the aperture and the succeeding transverse list, while the lower part below the aperture represents the lateral boundary between the thecae. This is clearly seen in his figure of the lectotype (Finney 1980, fig. 12c) where the thecal outline is preserved. It is therefore difficult to homologize the list structure in *Abrograptus* and *Reteograptus*.

The specimen figured by Elles and Wood (1908, p. 316, fig. 209c) shows the stipe characters of *Abrograptus* and cannot easily be regarded as a broken specimen of *Reteograptus* since there is no trace of the transverse or septal lists. Their illustration of this specimen unfortunately does not show the position of the sicula. In *Abrograptus* the sicula projects above the line of the stipes as in *Dicellograptus* but another specimen in the Lapworth Collection shows a proximal end with the sicula in the lower half exactly as in *Dicranograptus irregularis* Hadding where the biserial portion consists of only two or three pairs of thecae (Strachan 1986).

While checking through the collections of the British Geological Survey in Edinburgh, I was shown a partially exposed fragment identified as *R. geinitzianus* which matched the one on the Monograph plate. At my suggestion some matrix was removed by Peter Brand and a second stipe was revealed with the proximal end like a dicranograptid. We thus have four specimens showing this character and it seems reasonable to consider them as a new genus of Abrograptidae paralleling *Dicranograptus* in the Dicranograptidae.

SYSTEMATIC PALAEONTOLOGY

Specimens numbered BU are housed in the School of Earth Sciences, University of Birmingham, the GSE specimen is in the British Geological Survey, Murchison House, Edinburgh.

Genus METABROGRAPTUS gen. nov.

Diagnosis. Rhabdosome small, represented only by clathrial framework of a biserial proximal part (of ?four thecae in the type species) and two uniserial stipes diverging at 80 to 110°; sicula sclerotized normally.

Type species. *Metabrograptus scoticus* gen. et sp. nov.

Derivation of name. *Meta* (Greek – with) and *Abrograptus* as other new genera in the family bear Greek prefixes. The specific epithet indicates the country of origin.

Stratigraphical age and distribution. Upper Ordovician, Glenkiln Shales, probably *Nemagraptus gracilis* Zone, latest Llandeilian – earliest Caradocian, from the south of Scotland.

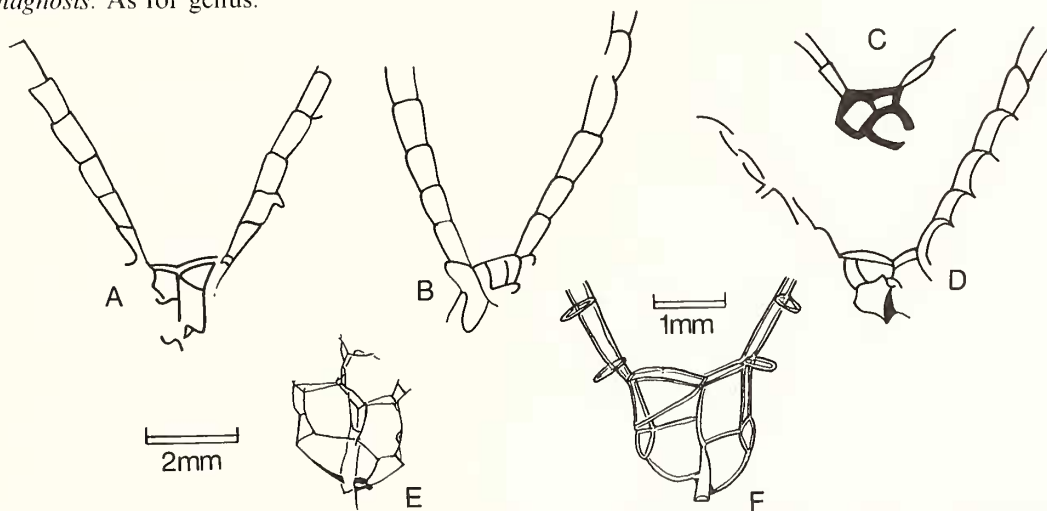
Remarks. This genus bears the same relation to *Abrograptus* as *Dicranograptus* does to *Dicellograptus*, that is, *Metabrograptus* has a short biserial portion whereas *Abrograptus* does not.

Metabrograptus scoticus gen. et sp. nov.

Text-fig. 1A–D, F

v 1908 *Retiograptus Geinitzianus* Hall; Elles and Wood (pars), p. 316, pl. 34, fig. 7d, fig. 209c.

Diagnosis. As for genus.



TEXT-FIG. 1. A–D, F, *Metabrograptus scoticus* gen. et sp. nov.; A, holotype, BU1336b; B, BU1336c; C, GSE14649; D, BU2150a; F, reconstruction of proximal end. E, *Reteograptus geinitzianus* Hall. Young growth stage, redrawn from Finney 1980, fig. 16j. All figures approximately $\times 5$, except F which is $\times 8$.

Types. Holotype, BU1336b, figured Elles and Wood, 1908, p. 316, fig. 209c. Glenkiln Shales, Birnock. Paratypes, BU1336c, same locality and horizon as holotype; BU2150a, b, locality unknown, Glenkiln Shales; GSE14649, Glenkiln Shales, Portsoy.

Description. The rhabdosome is quite small, the length of the biserial portion being 1.0 to 1.5 mm, and the stipes up to 8 mm long. The sicula appears to be normally sclerotized but details of the proximal end are poor in all specimens although they can be matched to some extent with Finney's (1980) figures of young stages of *Reteograptus* which supports its interpretation as biserial. The sicula is about 0.4 mm long. There is no distinct trace of a separate nema. The stout thread from the apex of the sicula forms part of the clathrial framework and ends at the level of the axil. A single strand from about the aperture of the sicula apparently represents the ventral line of the first theca and passes into an apertural loop. A second shorter thread connects the loop to the apex of the sicula. Above the loop, there are a pair of threads marking the lateral walls of th². On the opposite side of the sicula, a thread arising a short distance above the sicular aperture represents the ventral wall of the second theca and its apertural loop is connected on the obverse side by a short thread to the 'nema' and on the reverse side by a longer oblique thread to the centre of the axil. Above the loop there are again a pair of threads marking the walls of th².

The uniserial stipes consist of a pair of longitudinal threads divided into curved segments with apertural loops (appearing mainly as cross-bars) between the segments. The largest specimen has nine thecae on one of the stipes. The thecal spacing is 9–10 per cm. The stipes diverge at 80–110° from a broad axil which is clearly defined by paired threads in all specimens, thus differing from *Abrograptus* and *Parabrograptus* where there is only a single thread. The breadth of the axil varies from 1.4–1.6 mm, the narrower axil of BU1336c (1.1 mm) being due to oblique compression.

Remarks. Although the biserial part is badly preserved in the specimens available, comparison with Finney's (1980) growth stages of *Reteograptus* shows some strong similarities. A basic pattern of

four unequal meshes seems likely, ending in a pair of threads forming the axil which in one specimen at least can be divided into three subsections. The position of the thecal apertures is obscure but it is likely that the second pair of apertures is at the base of the uniserial stipes. An attempted reconstruction is given but much of it is speculative.

The curvature of the thecal lists shown in BU2150 is only hinted at in the Chinese figures of abrograptids which mainly show what are scalariform views of the stipes with the apertural lists appearing as cross bars. Similar views are seen in the Birnock specimens. The Portslogan example appears to be very heavily sclerotized although fragmentary but shows the same sort of contrast with the other specimens as is shown by Finney's old and young growth stages of *Reteograptus* (Finney 1980, cf. figs 13f and 16j).

The four specimens appear to be conspecific although they are from different localities. They are all clearly abrograptid in their uniserial stipe characters and distinct from previously described forms in the stout proximal end. Thus a new generic name is justified since the difference is paralleled in the Dicranograptidae. Whether the Abrograptidae should include fully biserial forms as Finney has advocated remains I think open to question. While the proximal clathrial structure which he has demonstrated in *Reteograptus* agrees well with that in *Abrograptus*, there is the problem that functionally when the periderm is reduced to a simple series of lists there is little scope for variation if the lists have a supporting function.

Associated fauna. The Birnock specimens are associated with a young specimen of *Cryptograptus tricornis* (Carruthers) and a slender stipe probably of *Nemagraptus*. The other Lapworth specimen, which is labelled *Coenograptus* (*Nema.*) *pertenuis*, has slender stipes presumably of this form as well as *Orthograptus* cf. *apiculatus* Elles and Wood, *Dicellograptus exilis* Elles and Wood, *Hallograptus* cf. *mucronatus* (Hall) and *Corynoides calicularis* Nicholson, indicating a horizon in the Glenkiln Shales.

Acknowledgements. I thank Jim Allan (St Andrews University) for photographing the specimens to provide a basis for the drawings and Peter Brand for looking out possible material from the Survey collections in Edinburgh.

REFERENCES

- BULMAN, O. M. B. 1970. Graptolithina. In TEICHERT, C. (ed.). *Treatise on invertebrate paleontology. Part V* (revised). Geological Society of America and University of Kansas Press, Boulder, Colorado and Lawrence, Kansas, xxxii + 163 pp.
- ELLES, G. L. and WOOD, E. M. R. 1901–18. A monograph of British graptolites. *Monograph of the Palaeontographical Society*, 1–539, 52 pls.
- FINNEY, S. C. 1980. Thamnograptid, dichograptid and abrograptid graptolites from the Middle Ordovician Athens Shale of Alabama. *Journal of Paleontology*, **54**, 1184–1208.
- JACKSON, D. E. 1966. On the occurrence of *Parabrograptus* and *Sinograptus* from the Middle Ordovician of Western Canada. *Geological Magazine*, **103**, 263–268.
- KOZŁOWSKI, R. 1951. Sur un remarquable graptolithe ordovicien. *Acta Geologica Polonica*, **2**, 86–93 [in French], 291–299. [In Polish].
- MU, A. T. (Mu Enzhi) 1958. *Abrograptus*, a new graptolite genus from the Hulo Shale (Middle Ordovician) of Kiangshan, western Chekiang. *Acta Palaeontologica Sinica*, **6**, 259–267, 1 pl. [In Chinese and English].
- MU, A. T. 1974. Evolution, classification and distribution of Graptoloidea and graptodendroids. *Scientia Sinica*, **17**, 227–238.
- MU, A. T. and QIAO, X. D. 1962. New material of Abrograptidae. *Acta Palaeontologica Sinica*, **10**, 1–11, 2 pls. [In Chinese and English].
- NI YU-NAN 1981. Two new genera from the Ningkuo Formation (Lower Ordovician) of Wuning, North Jiangxi. *Special Paper of the Geological Society of America*, **187**, 203–206, 1 pl.
- STRACHAN, I. 1986. The Ordovician graptolites of the Shelve District, Shropshire. *Bulletin of the British Museum (Natural History)*, (Geology), **40**, 1–58.

ISLES STRACHAN

12 St Nicholas Steading
St Andrews, Fife, KY16 8LD
Scotland

Typescript received 1 August 1989

Revised typescript received 23 October 1989